Remarks:

Claims 36-40 and 42-43 remain pending in the Subject Application. Claims 1-35, 41, and 44-54 are canceled. Claims 36-40 and 42-43 stand rejected. Claim 36 is amended to correct a matter of form. Thus, no new matter has been added by way of amendment herein.

Rejections – 35 U.S.C. § 103(a)

Claims 36-40, 42 and 43 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,613,468 to Simpkins et al. ("Simpkins"), in view of Japanese Patent Application JP 2000-294256 to Taruya et al. ("Taruya") as evidenced by U.S. Patent No. 5,424,144 to Woods ("Woods"). Applicant traverses this rejection for the reasons set forth herein.

Of the currently pending claims, claim 36 is the single independent claim. The Examiner relies on Taruya to teach the composition of claim 36. The Examiner asserts that the compositional limitations of claim 36 are disclosed in Taruya and that, therefore, the properties listed in claim 36 would have been inherent in what is taught in Taruya. After some miscommunication in the first 5 office actions, it has been clarified with Examiner Dove that Taruya does not in fact teach the following element of claim 36:

$$0.5 \leq (\%Nb + \%Ti + \tfrac{1}{2}(\%Ta)) \leq 1$$

(hereinafter the "Recited Range"). This was confirmed in a telephone interview with Supervisory Patent Examiner Pat Ryan on February 27, 2008. The Office now agrees with Applicant that Taruya does not teach the Recited Range in claim 36. Instead, Taruya teaches an alloy composition including less than 0.2% Ti (Taruya at paragraph 0047), and less than 0.3% Nb (paragraph 0049). Taruya does not mention any concentration of Ta. Thus, the total combined concentration of Nb, Ti, and Ta taught in Taruya is less than 0.5%, which clearly is outside the Recited Range. Accordingly, Taruya does not teach an alloy composition as recited in the claims of the Subject Application.

Nevertheless, the Examiner alleges that "the courts have ruled a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not

overlap but are close enough that one skilled in the art would have expected them to have the same properties" (page 3 of the Office Action), and "Applicant has not shown the ferritic stainless steel alloy of Taruya necessarily has different properties than the ferritic stainless steel alloy of the claimed invention." (Page 5 of the Office Action)

MPEP § 2144.05 states that "Applicants can rebut a prima facie case of obviousness based on overlapping ranges by showing the criticality of the claimed range...In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." As discussed below, the Recited Range of claim 36 results in alloy compositions having properties that were unexpected and surprising relative to compositions including a combined concentration of Nb, Ti, and Ta that is outside the Recited Range.

As discussed in the specification of the Subject Application, six heats of ferritic stainless steel were prepared and tested for various physical properties. The compositions of the heats are shown in the following table, which is reproduced from page 21 of the specification:

Heat	WC70	WC71	WC72	WC73	WC74	WC75
C	0.0026	0.0026	0.0038	0.0022	0.0023	0.0033
Mn	0.054	0.055	0.060	0.049	0.052	0.053
P	0.010	0.010	0.010	0.010	0.010	0.010
S	0.0029	0.0027	0.0014	0.0011	0.0003	0.0006
Si	0.16	0.15	0.14	0.15	0.15	0.15
Cr	25.52	25.98	25.63	25.77	25.69	25.79
Ni	0.096	0.094	0.095	0.094	0.094	0.095
Mo	1.05	1.05	1.03	1.04	1.04	1.04
Al	0.002	0.002	0.002	0.002	0.002	0.002
Nb	0.12	0.68	0.13	0.68	0.71	0.71
Ce	<0.001	<0.001	0.001	0.003	0.042	0.009
La	<0.001	<0.001	0.001	0.001	0.016	0.003
Zr	<0.001	<0.001	<0.001	<0.001	<0.001	0.011
N	0.0010	0.0010	0.0008	0.0009	0.0011	0.0011

Of the three elements included in the Recited Range, Nb was included in each of the above heats. Heats WC70 and WC72 are representative of a conventional ferritic stainless steel and do not satisfy the Recited Range. The remaining heats included higher levels of Nb and their compositions fall squarely within claim 1, including

satisfying the Recited Range. As discussed in the specification, ferritic stainless steels may provide a good thermal expansion match with the ceramic electrolytes of solid oxide fuel cells ("SOFCs"), but such steels typically exhibit low creep resistance, which is detrimental to their use in SOFCs. The present inventor unexpectedly discovered that relatively small increases in Nb concentration in certain ferritic stainless steel compositions yield a significant and surprising improvement in creep resistance at SOFC operating temperatures. The increased Nb concentration also surprisingly resulted in significant improvements in microstructural stability and certain other mechanical properties. Given the inventor's understanding of the mechanism that may be responsible for the unexpected and substantial improvement in alloy properties resulting from increases in Nb concentration, the inventor further concluded that Ti and/or Ta may be included in the alloy, either along with or in place of Nb, in a combined concentration that falls within the Recited Range to achieve similarly significant improvements in the properties.

Pages 24-26 of the Subject Application's specification as originally filed discuss the improvements in microstructural stability of the experimental heats included in the above table. The alloy compositions included in the table that do not satisfy the Recited Range readily recrystallized at 1750°F and also experienced significant grain growth at temperatures of about 1950°F and above. In contrast, the alloys listed in the above table that do satisfy the Recited Range did not show any evidence of recrystallization until heated to the substantially higher temperature of about 2000°F. Therefore, providing an alloy composition within the Recited Range unexpectedly and surprisingly inhibited recrystallization, preventing the phenomenon until the alloy was heated to temperatures substantially greater than the recrystallization temperature of the tested conventional alloys.

Similarly, pages 27-28 of the specification as originally filed describe the unexpected and significant improvements in yield strength, tensile strength and hardness exhibited by the alloys listed in the above table that satisfy the Recited Range.

Creep strength is discussed on pages 28-39 of the specification the Subject Application. The creep strength of conventional ferritic stainless steel alloys was

considered inadequate at the temperatures and under the mechanical stresses to which interconnects are subjected in SOFC applications. Modification of alloy compositions to satisfy the Recited Range, however, was unexpectedly found to significantly improve creep resistance. The alloys listed in the above table satisfying the Recited Range surprisingly exhibited significantly superior creep resistance compared to the conventional alloys, and the improvement was especially significant at higher test temperatures. For example, alloys satisfying the Recited Range exhibited creep rupture strength of 400 hours at 1000 psi and 900°C for. In contrast, the conventional alloys exhibited creep rupture strength of only 156 hours at lower pressure (900 psi) and lower temperature (900°C). This is summarized in the following table:

	Creep Rupture Strength (psi)	Temperature (°C)	Time (hrs)
Alloys within the Recited Range	1000	900	**400**
Alloys below the Recited Range	900	900	**156**

The alloys listed in the above table having compositions satisfying the Recited Range exhibited a time to 1% creep strain of at least 100 hours at 900°C under a load of 1000 psi. In contrast, the conventional alloys evaluated exhibited a time to 1% creep strain of only 2.5 hours at 900°C under a load of 900 psi. This is summarized in the following table:

	Time to 1% Creep Strain (hrs)	Temperature (°C)	Load (psi)
Alloys within the Recited Range	**> 100**	900	1000
Alloys below the Recited Range	**2.5**	900	900

Also, the tested alloys satisfying the Recited Range exhibited a time to 2% creep strain of at least 200 hours at 900°C under load of 1000 psi. In contrast, the conventional alloys evaluated exhibited a time to 2% creep strain of only 5 hours at 900°C under load of 900 psi. These results are summarized in the table, below.

	Time to 2% Creep Strain (hrs)	Temperature (°C)	Load (psi)
Alloys within the Recited Range	**> 200**	900	1000
Alloys below the Recited Range	**5**	900	900

Therefore, as clearly demonstrated in the specification of the Subject Application, adjusting the composition of a ferritic stainless steel alloy to satisfy the Recited Range (as well as to meet the other limitations recited in claim 36) results in a very significant and unexpected improvement in several properties including microstructural stability, yield strength, tensile strength, hardness, and perhaps most significantly, creep strength and time to 1% and 2% creep strain. These significant improvements yield a ferritic stainless steel suitable for use as interconnect materials in SOFCs, an application which prior to the present invention required use of substantially more expensive ceramic materials. Thus, it has been shown that an alloy as recited in claim 36 is novel for at least the reason that it satisfies the Recited Range. The Subject Application also clearly shows that alloy compositions satisfying the Recited Range exhibit unexpected, surprising, and significant improvement in several properties, including properties critical to materials used in SOFC interconnect applications. That the Recited Range results in these unexpected, surprising, and significant improvements clearly rebuts any *prima facie* case of obviousness established by the cited combination of references.

Applicant's additional arguments presented in previous Office Action responses are incorporated herein by reference, and are not repeated for sake of brevity. However, Applicant does not concede these arguments and reserves the right to expressly present previously presented positions if it should become necessary to do so.

Applicant respectfully requests withdrawal of the obviousness rejection and allowance of all claims pending in the Subject Application in light of the arguments presented herein.

Conclusion:

Applicant respectfully asserts that the claims of the Subject Application, as amended herein, recite subject matter that is patentable over the cited references. Applicant respectfully requests issuance of a Notice of Allowance at an early date. If, however, the Examiner is of the opinion that the Subject Application is in condition for disposition other than allowance, Applicant respectfully requests that the Examiner contact Applicant's attorney at the telephone number listed below so that those concerns may be addressed.

Respectfully submitted,

2/27/08
Date

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